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On the Availability of some Nitrogenous Manures.

(A preliminary report)

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THE use of oil-cakes to crops like sugar-cane is becoming more and more popular. A few of the more advanced agriculturists in the State have made a small beginning in the application of such artificial manures as sulphate of ammonia. As not very much is known about the availability of nitrogen in these manures under our conditions of soil and climate, a set of preliminary experiments was started in pots last year.

The soil used for the experiments was the usual red loam characteristic of most of our ragi fields. The manures experimented with were nitrate of soda, sulphate of ammonia, sunn-hemp, ground-nut, honge and castor cakes. The experiments were all quadruplicated with the usual precautions for pot experiments. The moisture in the pots was maintained at 70 % of the water-holding capacity of the soil. When completely saturated, the soil retained about 21 % of its own weight of water. The water lost through transpiration and evaporation was replaced once or twice daily as was found necessary and the crop grown was ragi. Seeds were sown on 12th July 1920 and only 12 plants were allowed to stand in each pot later on.

Each pot of the above series received two grams of nitrogen in one of its various forms. This small amount added to and mixed up with 15 kgs. of soil in the pot gives a ratio of 1 : 7500 which means a very small increase to the amount of nitrogen that may already be present in the soil. This quantity, even though it cannot be detected by chemical analysis of the soil, has influenced, as will be seen later on, the growth of crops to a considerable extent. To get an idea of some of the factors influencing the decomposition and the availability of the manures used, a second series of pots was manured with phosphates and potassium salts as well, whereas a third series was manured with calcium carbonate also in addition.

One would naturally expect that soluble manures like nitrate of soda and sulphate of ammonia make their effect felt on the crops from the very beginning. This was however not the case. For about two or three weeks after the plants had got well established, those pots that had received organic nitrogenous manures looked better than those that had received nitrate of soda and sulphate of ammonia. It was only after this that a change in favour of the soluble manures made itself gradually noticeable. Ammonium sulphate seemed to act better than nitrate of soda. In the organic manure series, castor-cake seems to have had the best effect; then came ground-nut, honge and sunn-hemp in order.

Plates I to III show the condition of the crop in the differently treated pots. The photographs were taken about three weeks before the harvest, and speak for themselves.

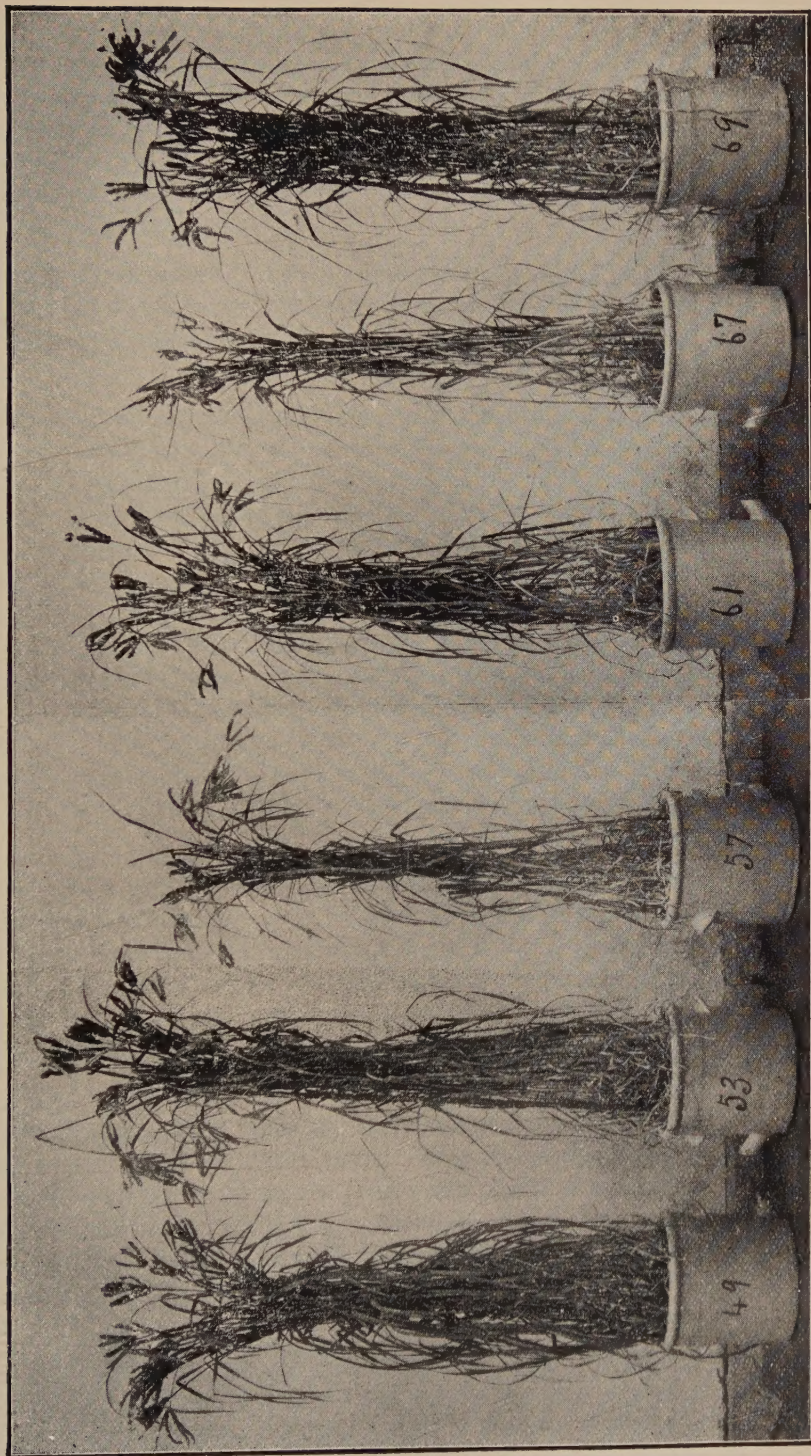
The crop was harvested on 6th November 1920. In addition to determining the weights of straw and grain obtained, the nitrogen recovered in the crop has also been determined. In the first of the three series, that with only nitrogenous manures, the yields obtained are given in Table 1.

The figures show that nitrate of soda has had the least effect on the crop with regard to the yield of grain and straw, as well as the recovery of nitrogen in the crop, while sulphate of ammonia has shown the best effect. After sulphate of ammonia follow castor, ground-nut, honge and sunn-hemp in order.

The yields obtained in the second series — with phosphate and potash in addition to nitrogenous manures — are given in Table 2.

Even in this series, sulphate of ammonia still retains its place with regard to the yield of grain and straw. Nitrate of soda, castor and ground-nut cakes have produced almost the same weight of grain. Honge cake and sunn-hemp occupy the third rank. With regard

PLATE II



POTS MANURED WITH NITROGEN, PHOSPHORIC ACID AND POTASH

49. Nitrate of soda 53. Sulphate of ammonia 57. Sunnhemp 61. Groundnut cake 67. Honge cake 69. Castor cake

to the recovery of nitrogen, sulphate of ammonia stands second even though it produced the largest crop. In the case of nitrate of soda, the crop is richer in nitrogen though the yield is not so much as in the case of sulphate of ammonia. Ground-nut cake, castor and honge cakes and sunn-hemp have supplied a quantity of nitrogen quite consistent with their crop yields.

Subtracting the figures in Table 1 from corresponding figures in Table 2, we get the difference in yield and recovery of nitrogen due to the additional manuring with phosphate and potash as given in Table 3.

These figures show that manuring with phosphoric acid and potash has enabled the plants to make use of the nitrate of soda to a very great extent. The series manured with sulphate of ammonia, ground-nut and castor cakes have also been benefited, but not to the same extent as those manured with nitrate of soda. This is just because the pots manured only with nitrate of soda gave low yields in comparison with those manured with sulphate of ammonia as seen from figures in Table 1. Why the nitrate of soda gave such low yields when applied by itself needs an explanation, and it can only be given later on when the series of experiments has been repeated and brought to a conclusion. The availability of nitrogen in sunn-hemp has not been materially increased by the simultaneous application of other manures. The same remark applies to honge cake with greater force.

It is a well known fact that the Mysore red soils are rather deficient in lime. Just to see whether an addition of it in the form of carbonate of lime would in any way influence the availability of the various nitrogenous manures, a third series was started and manured just the same as the second series but with the addition of lime. The yields obtained in this series as well as the amount of nitrogen recovered are given in Table 4.

Even in this series — the limed one — sulphate of ammonia has given the highest yield of grain and straw and it has almost been equalled by ground-nut and castor cakes. Nitrate of soda is also not far behind sulphate of ammonia. Sunn-hemp and honge cake have shown themselves far behind the others in action. By subtracting the figures in Table 2 from those in Table 4 we get the increased yields due to the action of lime added and they are given in Table 5.

The results show that the addition of lime has not contributed to any increase in yield except a very small one in the case of honge cake. In all other cases there has been rather a decrease, but much

importance cannot be attached to the slight differences shown. The recovery of nitrogen has been enhanced appreciably in the case of sulphate of ammonia which only means a higher quality of crop, so far as the protein content is concerned. Much significance cannot be attached to the slight increase in the recovery of nitrogen from honge cake.

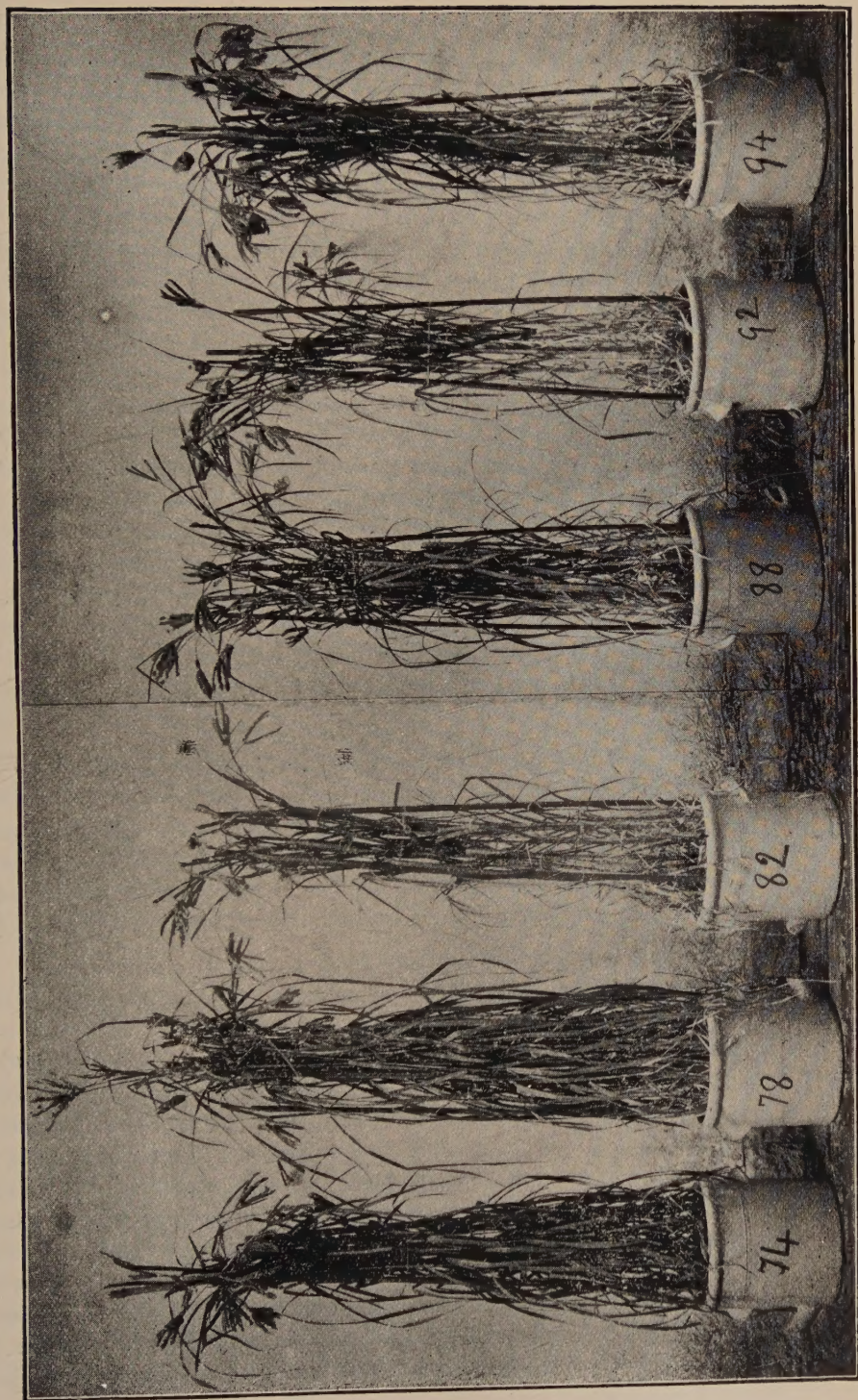
The percentage recovery of nitrogen in the crop from the various manures used varied according as they were applied alone or with other manures as detailed below :—

	from	to
Nitrate of soda	11.29	79.49 %
Sulphate of ammonia	44.36	91.15 „
Sunn-hemp	16.67	22.65 „
Groundnut cake	30.59	47.00 „
Honge cake	22.02	25.88 „
Castor cake	34.75	41.58 „

Of the two manures, nitrate of soda and sulphate of ammonia, the latter has given better results than the former in all the three series of experiments. This is not in accordance with the experience in western countries where nitrate of soda has invariably worked better than sulphate of ammonia. Whether the lack of humus in our soils has anything to do with it remains to be investigated.

Soon after the first crop of ragi was harvested, the pots were stirred to a depth of about 3 inches and kept moist to the extent of 70 % of the water-holding capacity of the soil so as to facilitate the decomposition of the root residues. The pots were again sown with an irrigated variety of ragi on 20th January 1921 to study the residual effects of the various nitrogenous manures used. The seeds germinated in quite a normal way. About three weeks after germination there were appreciable differences between the plants in the pots variously treated. Those that had received organic manures looked rather healthier than those that had received nitrate of soda or sulphate of ammonia. In the organic manure series, those that had received sunn-hemp looked the best, then followed in order those with honge, castor and ground-nut cakes. This is not at all surprising, for those that had done the worst in the first season had more nitrogen at the disposal of the crop for the second period of growth and probably in a well decomposed and hence in an easily available form. Most of the nitrogen as ammonium sulphate having been utilized by the first crop, the pure nitrate series of the second crop looked certainly better than the sulphate series.

PLATE III



POTS MANURED WITH NITROGEN, PHOSPHORIC ACID, POTSH AND LIME

74. Nitrate of soda 78. Sulphate of ammonia 82. Sunnhemp 88. Groundnut cake 92. Honge cake 94. Castor cake.

There was one thing noticeable in the pots which had received nitrate of soda. In the limed series, the column of soil had shrunk and had become impervious to water. The pots could be watered neither from below nor on the surface. When watered on the surface, the water would not penetrate the soil and when it had all evaporated, the surface of the soil dried up as hard as cement. The plants in these pots continued to be sickly in spite of all attempts to keep the surface loose and friable and trying to supply water to the plants sometimes by watering the pots on the surface and at other times by watering them from below. No such bad effect was noticeable in pots which had received nitrate of soda only. Those that had received phosphates and potash salts also were between these two extremes. A shrinkage of the soil column, and hardening of the surface was noticeable in all the pots which had been manured with nitrate of soda, of course in varying grades according as they had received other manures or not. Whether the richness of iron and alumina in these soils or want of organic matter is in any way responsible for such behaviour or whether there are any other causes contributing to it remains to be investigated. Before the effect of nitrate of soda on our soils has been properly studied in the laboratory as well as in the field, one ought to be very careful in advising its application at all.

The results obtained in this series of experiments can only be looked upon as indications for future work on these manures. The results themselves require confirmation by further pot experiments, and field experiments. Till all that is done, and some more data has been accumulated, it is not quite safe to enter into a discussion of all the theoretical points involved in an investigation like this.

The results obtained even in this preliminary series of experiments are not entirely without value for application in practical agriculture. The practice of applying oil-cakes to sugar-cane is extending slowly but steadily in parts of the province where it was formerly unknown. There are some advanced cane growers in the State who say that they have found it profitable to apply even three tons of ground-nut cake per acre. This quantity of cake contains about 540 lbs. of nitrogen, but from the results of the above experiments it will be seen that not more than 180 lbs. of it will be available to plants in about four months. The nitrogen requirements of a 40 to 50 ton crop of sugar-cane is about 150 lbs., and the major part of it may be required at the most vigorous period of its growth. A manure of such slow decomposition as oil-cake is not likely to supply the needs of the crop at its vigorous period of growth. More-

over the advantage of applying oil-cakes to sugar-cane might be partly due to the nitrogen and partly to the organic matter and the small amounts of phosphoric acid and potash contained in them. At the present prices, three tons of ground-nut cake cost nearly Rs. 240. If the same crop can be obtained by the application of 2 cwts. of sulphate of ammonia, one ton of cake and 4 cwts. of superphosphate per acre, the cost of manuring comes to about Rs. 150 an acre. It is in starting such field experiments that the above results serve as a useful indication.

TABLES.

TABLE 1.

Pot Nos.	Manure	Yield		Total ni- trogen in crop mgs.	Recovery of N in crop per cent
		Straw gms.	Grain gms.		
5-8	No manure ..	18'8	7'4	168'98	..
25-27	Nitrate of Soda..	33'3	16'8	394'86	11'29
29-32	Sulphate of Am- monia.	99'9	41'5	1056'20	44'36
33-36	Sunn-hemp ..	57'0	21'0	502'50	16'67
37-40	Ground-nut cake.	76'0	32'5	780'80	30'59
41-44	Honge-cake ..	64'7	27'4	609'52	22'02
45-48	Castor-cake ..	92'1	38'0	864'01	34'75

TABLE 2.

Pot Nos.	Manure	Yield		Total nitrogen in crop mgs.	Recovery of N in crop per cent
		Straw gms.	Grain gms.		
49-52	Nitrate of Soda..	120'0	54'3	1763'04	79'7
53-56	Sulphate of Ammonia..	141'6	62'2	1433'36	63'2
57-60	Sunn-hemp ..	78'7	30'2	622'01	22'6
61-64	Ground-nut cake.	106'5	53'4	1109'52	47'0
65-68	Honge-cake ..	68'3	28'1	591'90	21'1
69-72	Castor-cake ..	116'3	55'5	1140'71	48'5

TABLE 3.

Manuring	Excess yield of		Excess recovery of Nitrogen in	
	Straw gms.	Grain gms.	mgs.	per cent
Nitrate of Soda ..	86'7	37'5	1268'18	68'4
Sulphate of Ammonia ..	41'7	20'7	377'16	18'8
Sunn-hemp ..	11'7	9'2	119'51	5'9
Ground-nut cake ..	30'5	20'9	328'7	16'4
Honge-cake ..	3'6	0'7	-17'6	-0'9
Castor-cake ..	24'2	17'5	276'7	13'7

TABLE 4.

Pot Nos.	Manure	Yield		Nitrogen in crop mgs.	Recovery of N in crop per cent
		Straw gms.	Grain gms.		
73-76	Nitrate of Soda..	134'4	48'0	1756'80	79'49
77-80	Sulphate of Ammonia.	137'5	53'1	1999'68	91'15
81-84	Sunn-hemp ..	76'8	26'3	528'48	17'98
86-88	Ground-nut cake.	104'0	51'0	1089'60	46'00
89-92	Honge-cake ..	74'4	30'4	686'72	25'88
93-96	Castor-cake ..	124'8	50'9	1100'80	46'57

TABLE 5.

Manuring	Excess yield of		Excess recovery of Nitrogen in	
	Straw gms.	Grain gms.	mgs.	per cent
Nitrate of Soda ..	14'4	-6'30	-6'24	-0'21
Sulphate of Ammonia ..	-4'1	-9'10	566'32	27'95
Sunn-hemp ..	-1'9	-3'90	-93'53	-4'78
Ground-nut cake ..	-2'5	-2'40	-19'92	-1'00
Honge-cake ..	6'1	2'30	94'82	4'88
Castor-cake ..	8'5	-4'60	39'91	-1'97

Ways adopted in Java for the development of the Coffee Industry.*

BY

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MY knowledge of agricultural conditions in Java is based on fifteen years' residence there as a planter, and during that time I have seen many changes, changes in the relation of the Government to the people, and changes due to a difference in the *planting* community.

In Java, as here, we have a native population and a foreign Government (the word "Native" is necessary as there are many other people, besides the Javanese, that come under that title). During this period of fifteen years, as also since, the Dutch Government has been gradually handing over to the native population more and more power in the management of their own affairs.

In every grade of the Government service, except that of the Governor-General and that of the Governors, there are two officers of the same status, one being a Dutchman and the other a member of the Javanese ruling classes. The Dutch Officer is called "My Elder Brother" by his co-worker and the relation between them is such that, if the Dutch element were withdrawn, the Government structure would still stand, each grade having efficient officers of Javanese.

In this way the relation between the two races has been more natural, more cordial, and more adapted to progress than would have been the case otherwise.

In the various towns there are councils—*raden*,— of which Dutch, Arabs, Chinese, Javanese, etc., are members. The latest development in Java has been a Parliament, in which the people's representatives may, and do, belong to any of these races.

In all such matters, the Dutch East Indies have been in advance of this country and much may be learnt from our experience of these reforms, which would be useful to politicians and to ordinary citizens here.

*A lecture delivered at Chickmagalur on the 18th May 1921.

We may mention two typical ways in which the Dutch Government has greatly helped the ryots.

In every village there is a Government Granary. The ryots pay their taxes to Government, *not* in coin but in paddy they have grown. They are allowed during the year to buy back the paddy at a fixed price and any paddy not bought back is sold by the Government before the new paddy harvest. This system is very much appreciated and has done much to obviate famine; the paddy can be easily transported in times of difficulty from one part to another. The system is also a check on too much paddy being exported.

Another way in which the Government helped the ryots was to take over their indebtedness to the many money-lenders; the debts were then owed to the Government and a system elaborated by which, by easy instalments, the debts and a reasonable five per cent interest would be all paid off, not later than twenty years after the assumption of the debts by the Government.

Such practical help has made the ryot to realize the value of what he familiarly calls "Father Government."

With regard to the *planting* community, it is practically entirely European,—very few Javanese taking up estates.

The change in the planting community has been very noticeable and has been the cause of the great advance in agricultural matters.

In the "good old days" planters were only too often the never-dowell sons of good families in Holland, shipped off to the Dutch Indies to look after themselves. The consequence was that many of the planters were rough, uneducated (as we count education in these days) and often lazy.

Now-a-days, however, the planters are more men with a good University education obtained in Holland, desirous of bringing their plantations into as scientific, orderly, and up-to-date a condition as possible. Some have specialised in the Agricultural College of Wageningen, and are experts in some higher branch of agriculture. Their presence has naturally refined the social tone of the planting community and has also led to a great development of agriculture: theoretical knowledge and practical experience have gone hand in hand and the result may be guessed.

These young men at once put themselves in touch with the Government Agricultural Department at Buitenzorg. Here are situated the Botanical Gardens of Java, of which I need not say much as their reputation is world-wide.

The next development was to attach to the Gardens an Agricultural Department with an inquiry department for *all* matters agricultural.

The planters' inquiries *constantly* stimulated this department into more activity and, an elaborate scheme of small experimental farms and plots all over the country was *one* result. Thus there are experimental tea and coffee, rubber gardens where experiments in different methods of cultivation, distances of planting, manures, new varieties, etc., are constantly made.

In the case of coffee, several new varieties were imported, varieties for high, medium and low altitudes, varieties requiring shade or no shade, varieties requiring moisture and those resisting drought.

Many of these imported varieties came from Central Africa, the Congo, and other parts where they grew wild, and they were planted in those experimental plots, whose conditions most nearly resembled those of their native homes. Thus, in some of these five to ten acre plots in the *arid* tracts of Java were tried new varieties from *arid* tracts of Africa.

Then careful selection and other scientific treatment was applied until there were ready for the market, varieties of coffee, all heavy croppers, suitable for the many divergent conditions of Java. To name but a few,—Quilon, Robusta, Uganda, Camphora, Sankurnensis, Camphora Coffee Laurentiai, Stenophylla, Excelsa. But, *apart* from all this Government activity which was of great benefit to the planters, we find the latter, associating themselves into groups of coffee, tea and rubber planters, and then starting their *own* association-experimental-farms. In charge of these, they put the cleverest man they could attract, regardless of his nationality, and paid him a most liberal salary, gave him "*carte blanche*" as regards funds and men, *absolute* liberty of action, *but* expected results.

The manager of the association-farm communicates his results and discoveries immediately, to *all* the planters of the association. These again co-operate, testing the advice given in their own locality.

For instance, if a new method of cultivation is recommended, the planters apply this to a small part of their estate and report results.

The expenditure on the experimental station of the association has been returned to the association *manifold* by the *increased* yield of their estates.

It is *this* line of action which has given such a good name to the planters of Java.

Many are drawn away to other countries by offers of attractive salaries and good prospects.

Although I understand that Robusta coffee has not in this district proved such a heavy cropper as with us, still as many of the conclusions arrived at, with regard to it, are of *general* application, I should like to describe to you some of these conclusions.

Sir George Watt, in the Commercial Products of India, says "Mr. Leeming of Scotforth in the Shevaroyes has demonstrated the necessity for a larger spacing of coffee trees." He says : "The opinion was that the trees were in a *healthier* condition and were found to be fruiting more vigorously than any coffee seen elsewhere. The yield has been greatly increased, the cost of cultivation lessened, the plants rendered better able to throw off disease and the produce is recorded as fetching a higher price than had been the case under the former conditions."

This is a most splendid *testimony* to this new system of planting, and should show that it is worth while planting, at any rate a couple of acres, so that the individual planter may convince himself of the benefits, resulting from this larger spacing.

It will be of interest to know that planters in Java have come to the same conclusion. Eager to find new and improved methods that would make coffee planting more profitable, they drew up a list of fundamental facts.

They argued that in order to introduce better methods, one should have a *clear* understanding as to what the requirements of the tree were and under what conditions the tree could grow and produce to its *fullest* capacity.

We learn that these fundamental facts are :—

(1) that Robusta requires moisture, suffers from drought, especially in heavy clay soil, and that it is therefore necessary to protect its root system.

(2) that every tree requires for its maximum development sufficient space and that the branches therefore should not touch those of another tree.

(3) that in order to get a larger production, the largest quantity of fruit-bearing wood is required and this is only possible when *none* of the branches have died off.

(4) that the dying off of the lower branches is due to *lack of light* (This is most noticeable on estates where the coffee and shade trees have been crowded and where the coffee trees have the usual umbrella shape).

It will be easy for every planter to see where improvements could be made, if he considers these facts carefully. Usually the distance between the coffee plants is six or seven feet. We may state that this distance of planting has arisen, because the plants *then* begin to close up after two years, and shade the soil. The weeding expenses are thereby considerably lessened and the shade helps to preserve the moisture, which the plants so badly require. Their root system is thus protected from exposure.

Although it is true that moisture in this way can be preserved, this is obtained at the expense of the lower branches. After three years the branches begin to interfere with one another, overlap one another and the struggle for life begins. Only the higher branches receive sufficient light, the lower ones gradually sicken and die off, and we get the usual umbrella shape.

In order to meet the requirements of moisture and the protection of the roots, *without* incurring this loss of branches, *another* method has clearly to be adopted. This can be done by carefully collecting all the prunings of the shade trees, any green manure and coffee leaves, placing them in heaps, and when all is well decomposed, placing it under the coffee plants, mixed with the soil from the air-pits, which have been dug for soil-aeration. (Air pits are necessary for a good root-formation and for a better growth of leaves and of stems. They allow for continuous exchange of atmospheric and soil gases, which is so essential for the good health of the trees).

This will form the necessary humus, which is so badly wanted by the trees, and when brought under the tree will not only prevent evaporation, but increase the amount of moisture through its greater power of absorption and will retain such atmospheric gases as nitrogen, oxygen, carbonic acid gas and water vapour; and thus help the formation of nitrates, ammonia, and plant food in an *available* form.

Nobody will deny the fact that every tree requires sufficient room and light for its *healthy* growth and it is for this reason that the trees, that have been planted at twelve feet distance, show such a much better growth than that found in the usual six feet plantations. It is true that it takes a longer time for the branches to meet, but against that stand the following advantages:—

- (1) The *whole* tree from top to bottom will produce fruit.

(2) The tree is able to make new fruit-bearing wood, during the period of fruit-bearing, which is not possible when there is lack of light. In closely-planted estates, a year with a large crop is always followed by one with a small crop. The shade affects the tree, it is covered with leaves, but no fruit-bearing wood is to be seen, all the fruit-bearing wood remains green and sappy (succulent) with the result that there is little or no crop.

(3) The tree with plenty of light is able to resist drought much better. It will also be less affected by scale and other pests. Shade is a thing which Robusta coffee does not like much, so that shade trees planted at twenty-four feet distance, instead of at the usual twelve feet will suit the plant better. Even then, severe pruning of the shade trees will be still necessary. In Java the *silver oak* is often used as a shade tree. It is on the whole an extraordinary tree, which does not at all mind ill-treatment. If the tree is cut down, it will make half-a-dozen new stems. The leaves seem to give only a little shade, but when the tree is well-grown it has a good crown. The leaves decay easily and make a splendid green manure.

As to *topping* the coffee trees at five or six feet, this is often unavoidable on many estates where the hill-slope is too steep and untopped trees would make it almost impossible to pluck the fruit where ladders are of no use. Where the soil is level, it would certainly pay *not* to top the trees.

In Brazil, the distance between the trees is twelve feet. Three plants are planted in one hole, and these are allowed to grow in huge columns without topping, and receiving sun on all sides, they give a most tremendous quantity of produce.

As regards *pests*, too shady gardens form a breeding place for scale and mould, which causes the top of the branches to die off. We would suggest the following for an ideal estate, which is practically level. (*Vide* chart).

The distance of the trees in the lines is twelve feet, and there are three plants to a hole. The distance between the lines is alternately twelve feet and eighteen feet. The larger space contains long, oblong air-pits, two by three by twelve feet, and lines of green manure (usually sunn hemp or some other low-growing leguminous plant). The pits prevent any washing away of the surface soil by heavy rains.

Where the estate is situated against the slopes of hills, terraces should be made and all washing away of the soil prevented as much

as possible, by the planting of green manure on the *outer* side of the terraces, and by allowing it to protect the slopes of the terraces.

In this way no such thing is possible as coffee trees with their roots standing half a foot or one foot above the soil, all the surface soil having been washed away.

CHART.



**The Cultivation of Chillies (*capsicum frutescens*) at
Kottamangala, Mulbagal Taluk, Kolar District.**

BY

N. Venkatasubbayya,
Secretary, M. A. & E. Union.

Soil.—In this locality chillies are grown on red and loamy soils. better crops being usually obtained on red soils.

Season.—There are two seasons for sowing chillies. For one crop, the nursery is sown early in the month of *Chaitra* (April) the crop being harvested in the beginning of *Ashadha* (July). The nursery for the other crop is sown early in *Ashadha* and the crop is harvested in *Asvija* (October).

Preparatory cultivation.—The field is ploughed four times with the country plough.

Manuring.—Usually about 24 cart-loads of cattle manure is applied to the acre. Half this quantity is applied at the time of ploughing and the other half is applied in furrows at the time of irrigation.

Seed rate.—About $7\frac{1}{2}$ measuring seers of seed are required for an acre.

Transplanting.—20 to 25 days' seedlings are transplanted in furrows on soil previously prepared and manured as mentioned above.

Inter-culture.—The soil between the rows is hand-hoed once after about 25 days of transplanting. Eight days after hoeing, the ridge between the rows is broken, both green and dry leaves as well as cattle manure are spread between the rows and the soil with this mixture of leaf and manure is spaded on to the bottom of the plants so that the manure goes to the bottom and the soil falls over it. What was the ridge before now becomes the furrow and *vice versa* with plants growing on the ridge.

Irrigation.—Irrigation is given once in four days, care being always taken simply to moisten the soil well without flooding the field. Sometimes a sprinkling of manure is given and the interspace is hand-hoed.

Yield.—The field with which the following cost of cultivation is concerned is $\frac{1}{2}$ acre and yielded 5 maunds of chillies.

Diseases.—At flowering time a disease called “Benki roga” or “Thale mudi” attacks the crop. The leaves droop and terminal buds wither away. Either the flowers themselves or the tender chillies drop off. It is believed that a shower of rain at this time checks the disease.

COST OF CULTIVATION AND YIELD. AREA $\frac{1}{8}$ ACRE.

	Rs.	A.	P.
4 ploughings with the country plough ..	1	0	0
Value of seed and nursery, etc. ..	1	0	0
Transplanting	0	12	0
Hand-hoeing after 25 days. 4 male coolies at 4 annas a day	1	0	0
Earthing up, 4 coolies	1	0	0
Value of leaves for manure	1	8	0
Manure 4 cart-loads	2	0	0
Picking	3	0	0
Irrigation	4	0	0
Total ..	15	4	0

INCOME

5 maunds of chillies sold at Rs. 6—8—0 per md.	32	8	0
Less, cost of cultivation	15	4	0
Net income ..	17	4	0
Per acre ..	103	8	0

The Necessity for a Model Farm in every Taluk.

BY

C. Bhima Rao,

*Land-owner and Honorary Supervisor of Co-operative Societies,
Channagiri.*

WE are accustomed to hear that people in foreign countries are far ahead of us in agriculture but few of us attempt to follow them. For, these matters cannot be sufficiently realized until they are demonstrated and seen. Government have appointed a number of trained agricultural officers for the benefit of ryots and these men have been spreading the gospel of improved agriculture

far and wide. But their advice cannot carry sufficient conviction with the ryot because he cannot see practised near by all these improved methods which are talked of. It is for this reason that I plead that Government should establish a model farm of not less than 25 acres in every taluk, and demonstrate improved methods of agriculture so that the ryot might see for himself the advantages of following such methods.

These farms might be established either by Government direct or through private agency, that is to say, by affording facilities and offering assistance to any enterprising local agriculturist who might come forward to undertake such work. Should the Government undertake the work themselves, the expenditure under every item would be high. Entrusted to local men the cost of establishing such farms would be considerably reduced. The probable expenses under both the methods are detailed below :—

GOVERNMENT CONDUCTED MODEL FARM.—

Non-recurring :—

			Rs.	A.	P.
Dwelling house	..	..	3,000	0	0
Well	..	..	1,000	0	0
Two pairs of bullocks	..	..	600	0	0
One cart	..	..	100	0	0
Implements	..	..	200	0	0
Other items	..	..	100	0	0
Total	..		5,000	0	0

Recurring annual expenditure :—

Manager	..	..	500	0	0
Maistry	..	..	180	0	0
Permanent coolies, 5 men		..	480	0	0
Feeds and fodder for cattle		..	250	0	0
Temporary coolies	..	..	500	0	0
Seeds, manures, etc.	..	..	490	0	0
Total	..		2,500	0	0

Total of recurring and non-recurring expenses	..	..	7,500	0	0
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FARM CONDUCTED THROUGH PRIVATE AGENCY.—

Non-recurring :—

			Rs.	A.	P.
Dwelling house	..	..	800	0	0
Well	..	..	1,000	0	0
Cattle	..	..	400	0	0
Cart	..	..	100	0	0
Implements, etc.	..	..	200	0	0
Total ..			2,500	0	0

Recurring annual expenditure :—

Maistry	..	..	180	0	0
Permanent coolies, 5 men	..	..	480	0	0
Cattle feeds and fodder	..	..	250	0	0
Temporary coolies, seed, manuer, etc.	..	..	500	0	0
Other items	..	..	90	0	0
Total ..			1,500	0	0

Total of non-recurring and recurring expenditure

4,000 0 0

Conducted by Government direct, the cost of establishing a farm during the first year would be nothing less than Rs. 7,500 but conducted through private agency with Government assistance Rs. 4,000 would be enough : *i.e.*, Rs. 2,500 less in non-recurring and Rs. 1,000 less in recurring annual expenditure. Besides, a private man for fear of losing, will spare no pains in managing the farm efficiently. It seems to me advisable to encourage such farms being established through private agency, Government assistance being offered subject to the following conditions :—

(1) Out of Rs. 2,500 required for buildings, etc., Government shall bear half the amount, the other half being offered by Government as a loan.

(2) As regards the recurring annual expenditure of Rs. 1,500, Government shall meet the expenditure in full during the first year, half the expenditure during the second and third years and Rs. 300 and Rs. 200 during the fourth and fifth years respectively. The produce from the land shall be the land-owner's.

(3) The land-owner who agrees to these conditions shall manage the farm without expecting any monetary help from Government for ten years after the first five years,

(4) The farm shall be managed and proper accounts kept under the direction of the Department of Agriculture.

(5) From the time the work is commenced, the Department of Agriculture shall advance amounts not exceeding Rs. 500 at a time, the advance being recouped from time to time as necessity arises.

(6) The amount given as loan shall be paid back in twenty annual instalments commencing from the sixth year.

(7) Failure to abide by the above conditions shall render the estate liable to be forfeited to Government.

A farm managed by private agency as aforesaid will cost Government Rs. 4,500 during 15 years, *i.e.*, Government will have expended Rs. 300 annually on such a farm. The same farm managed by Government would cost Rs. 27,000 deducting the value of produce during a similar number of years.

With the help of such farms, Agricultural officers while touring can very effectively instruct the ryots in improved methods of agriculture; the ryots can see for themselves on these farms how best a farm might be conducted and the object of the Department will be achieved better and sooner than it is possible otherwise.

Notes on the more Important Insect Pests of Crops in the Mysore State.

BY

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Assistant Entomologist, Mysore Agricultural Department.

(Continued from our last issue.)

VIII. Citrus Borers.

- (i). *Chelidonium cinctum*.
- (ii). *Chloridolum alcmene*, Thoms.

(Mysore Agricultural Calendar 1920, pp. 41).

All citrus trees, viz., limes, oranges, citrons, pomelos, etc., are subject to attack by the grubs of two species of beetles. The common species found in the State is *Chelidonium cinctum*, while the other one is rare. The beetles are found in the winged state in the months of April to June and eggs are laid on the plants during these months.



The grubs on hatching bore into the twigs and branches of the trees and by the time they are full grown, long hollow tunnels are made in the stems of plants and they are thus weakened. In the case of small twigs wilting and drying up begin a couple of months or three after the grubs gain entry into them, but large stems and branches are able to withstand the attack a few seasons. The plants look unhealthy and the crop of fruits is very much reduced. The attack on the plants is very easily detected by the saw-dust like white powder thrown out by the larvæ from the tissues of plants attacked.

Control.—Pruning off the small twigs with the grubs inside and destroying the same by burning. In the case of thick stems and branches, a mixture of equal quantities of phenyle and water is

injected into the holes and the latter closed with wet earth. This was found effective in killing the grubs inside the stems to a great extent.

IX. Stored Grain Pests.

There are several kinds of small beetles attacking stored grains and provisions. One set belongs to the family Bruchidæ, another belongs to Curculionidæ, a third to Cucujidæ, etc.

(a) Pulse Beetles.

(*Mysore Ento. Bulletin No. 6*)

(*Mysore Agricultural Cal. 1919, pp. 13*)

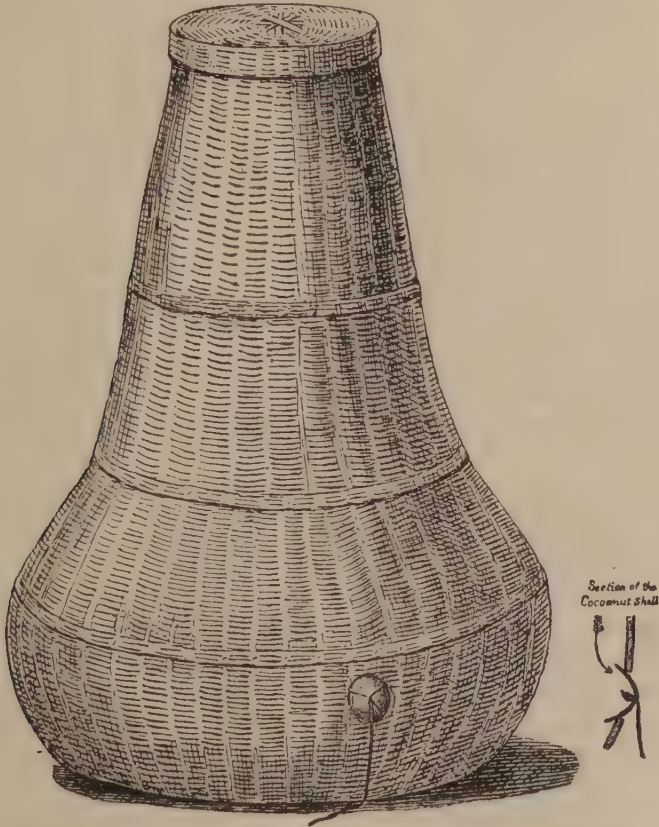
There are 4 species of the family Bruchidæ that attack the grains in store of which the most common is *Pachymerus (bruchus) chinensis*. The grains attacked in store are red gram (*togare*) horsegram, lab-lab (*avare*), black gram, etc. The beetles have a very wide distribution in the State.



Eggs are laid on the grains, the eggs hatching out bore into and eat away the substance of the seeds and develop there. Pupation takes place inside the grains. Thus the grains are rendered unfit for human consumption, or for sowing purposes. The time taken for the development from the egg to the adult is from 3 to 6 weeks.

Control.—It has been found out that the beetles have to come^e up to the surface of the grain in store for egg-laying. Advantage was taken of this knowledge to devise a very simple method of protecting grains in store. This method is to spread a layer of sand to a thickness of about 2 inches on the top surface of the grain in

store. The insects come up to the surface of the sand and thus they are cut off from the seeds which thereby escape damage. Grain when required is taken out through a hole of the type seen in many wicker bins in the State and pictured below :—



(b) There are various other beetles belonging to different families doing damage to stored paddy, jola, wheat, etc. The injury is similar to the previous insect and the same treatment may be adopted for all.

X. *Sthenias grisator*, Fb.

(*S.S.I.I.*, pp. 326)

This is a longicorn beetle dark grey in colour with whitish patches on the wings. This occurs as an occasional serious pest of the Grape Vine in Bangalore and Mulberry in Kolar. The beetles are found in January–February.

The insects ring the above plants, and the portions above the injured area die. It is a more serious pest on the grape vine than on mulberry. Grape vines are generally trained in Bangalore in overhead trellis work and the beetles are found ringing the main stem

of the vine. Thus grape vines that have long years to live and yield fruits, dry up. In the case of mulberry, only a few plants out of an acre are affected.

Eggs are laid by the beetle on the portion of the twig above the ringed area. The life history has not been studied yet.

XI. *Trachys bicolor*, Kerr.

(*Bom. Nat. History Journal*, Vol. 27, p. 178)

This is a small steel-blue beetle with white wavy lines on the elytra. The head and thorax are of a bronze colour. The insect is a leaf-miner on "*Butea frondosa*" and it is found very widely distributed in the State.

The insect lays small round colourless eggs on the upper surface of the leaves, the former turn to shining black in 6 days. The grubs hatching out bore into the leaves and gradually convert them into pockets which turn to a brown colour. The leaves have a blistered appearance now. Pupation takes place inside the pocket and the adult beetles come out cutting a hole through the lower portion of the leaves. The adult beetles also damage the plants by eating up the leaves. The period from the egg to the adult is 56 days. There are about 4 to 5 generations in a year.

XII. Sugar-cane Root Grub.

Very large numbers of grubs were found damaging young sugar-cane roots in a few fields in Devanahalli Taluk, Bangalore District, in July to September 1920. Grubs in all stages of development were found on digging about the roots of sugar-cane. The soil is of a sandy nature and the sugar-cane is irrigated from small wells. The grubs were not found in soils of a stiff nature and also in lands irrigated from a tank.

Control.—Nothing could be done except the digging out of the grubs from near the roots of withered plants.

XIII. The Paddy Dynastid.

This is a small black beetle found damaging the roots of paddy both on the nursery and in the transplanted fields in Balchonnur, Kadur District, in October 1915. The adult beetles were able to remain under water for a long time. In a fairly grown-up paddy field of about 4 months old where water was standing a few inches deep, the beetles were observed to come up to the surface of the water for a couple of seconds and again dive down and disappear. The beetles were noted as a pest only one year. The life history, habits, etc., have not been studied fully.

Control.—Kerosening the water of the paddy field was tried but the beetles were not in sufficient numbers to find out the result.

XIV. *Scelodonta strigicollis*, Mots.

(*S. S. I. I.*, pp. 309.)

This is a very small dark brown beetle with six small dark round spots on the wings. This is an occasional serious pest of grape vines. In addition to eating up the leaves, it scrapes up the surface of the immature canes and shoots in patches. Life history has not been worked out. In a 10-acre vineyard where the European method of training the grape was practised with a low head of 2 feet and the vines 10 feet apart without any trellis work the pest appeared in a very serious form some years ago. It was very easily got rid of by a dealwood box 3' x 3' with one side open with a U-shaped slit on one plank at the open side. The inside was tarred. The whole plant was enclosed in the box by shoving in the stem in the slit, and by shaking the plant a little the beetles were dislodged and they got stuck to the tarred inside. In 4 days the 10-acre vineyard was completely cleared of the pest. I have not seen it occurring as a serious pest on vines trained according to the local method.

XV. The Jack Fruit Weevil.

This is a very small light brown weevil found breeding in large numbers on young jack fruits in the cold season, October-January. The insects are found wherever jack fruits grow in Bangalore. They are also found in Chickmagalur, Kadur District. The weevil has been found to attack only the male inflorescence. So far no female inflorescence has been found attacked. A puncture is made on the soft upper portion of the fruit and within this puncture the egg is laid. A large number of eggs are laid in each fruit—in one case a little over 25 grubs were found in a small fruit the whole inside of which was found to be completely tunnelled. The grubs pupate inside the tunnels in the fruit and the adults emerge by cutting a small hole in the surface. By the time the adults emerge, the fruits are found to have dried and either dropped down or sticking on the twigs and branches of the tree. It has not been ascertained how far the fertilization of the fruits is affected by the large amount of destruction of the inflorescence.

XVI. The Black Gram Weevil.

This is a very small, black, ant-like insect found to breed in very large numbers on black gram pods in October-November, 1920. This is the first time the insect has been noticed in Chathanhalli, Mysore. Over 2 acres of black gram was found almost completely destroyed. The weevils were found scraping up the epidermis of the leaves and feeding, thus damaging them.

(to be continued.)

NOTES AND COMMENTS.

BY THE EDITOR.

Revision of Scale of Pay in the Indian Agricultural Service.

We note with much satisfaction the revised scale of pay sanctioned by the Secretary of State for the Officers of the Indian Agricultural Department in British India. The scale and the rules relating to the increment are extracted in our "Selections." It will be noticed that officers now start on Rs. 500, and rise to Rs. 1,750.

* * * * *

Filled Milk.

We read that one of the milk substitutes largely used in the United States of America is a preparation of skimmed milk containing cocoanut-oil. They are sold as fresh milk not only to families but are served in hotels, restaurants and boarding houses. They are also largely used by ice-cream factories for the making of ice-cream. In 1920, about two and half million cases of this milk are said to have been made and sold, being the equivalent of 8 million pounds of butter.

* * * * *

Books on Agriculture to Members of the Union.

We invite the attention of members to the notification by the President published elsewhere in this number of the Journal, giving a list of books available for being lent out to members from the Library of the Department of Agriculture, along with the rules framed in that behalf. We trust members will largely avail themselves of this privilege.

* * * * *

Germination Tests.

Does the ryot ever test his seed for germination before he sows it? We must confess to never having even once come across an instance of such a test by the ryot. It cannot be said that the seeds the ryots sow are always of first class quality and that the risks against which such tests protect one do not exist in the case of the ryot. It is true that there is no seed trade in the country and that as a general rule all ryots other than the very poor, set apart seed grain out of the produce of their own fields and also take considerable care in the matter of storing it. It is also true that the unnecessarily large seed

rate, which is common, is a practice which to some extent reduces the risks. Nevertheless cases are not at all rare of seeds of indifferent quality having been sown and the fact discovered, of course, too late to mend. We have moreover had occasion to test seeds taken out of the ryot's basket from seeds actually being sown, and have nearly always found them not at all up to the mark, the ryot making up for this defect by sowing often three or four times the quantity that may otherwise be enough. There is also a certain amount of seed which the ryots either buy in the *Santes* and bazaar or get in exchange from localities other than their own in the belief that such a change of seed is beneficial. The ryots rely upon the outward signs of poor quality in seed such as discoloration or a musty odour and of signs of insect attacks for discarding poor seeds; but seeds may pass this test and yet fail to germinate. It would be well if our ryots would realize the advantages of a germination test both in the case of the seeds raised and stocked by themselves and of seeds purchased or obtained from elsewhere. They could thereby guard themselves against considerable risk and the simplicity of the test makes it easy of adoption by all.

* * * * *

Book-keeping for Farmers.

It will be remembered that our Union is engaged in drawing up some forms of Farm accounts which can be kept by all our literate farmers without much trouble and which will at the same time give all the essential information required. Certain forms which were drawn up came for discussion at the last annual meeting, but these were considered somewhat too elaborate and were referred back to a sub-committee for revision with a view to making them less complicate.

Members may be interested to know we have in this matter fallen into line with the Agricultural Societies of a country where agricultural organization is considered the best in the world, *viz.*, Denmark. Agricultural Societies in that country desirous of taking to systematic book-keeping engage an accountant who puts members in the way of maintaining these accounts, by helping them to make the daily entries, making up the monthly labour, cash, fodder and other accounts, drawing up the yearly balance sheet and analysing the accounts. The society itself charges members from 2 to 6*d.* per acre of the Farm to meet the expenses, and the Government grants a subsidy amounting to one-half the salary, travelling and office expenses of the accountant, if the Government standard of book-keeping is adopted and the balance sheets published.

* * * * *

Sulphate of Iron for Chlorosis.

Satisfactory results in the treatment of Chlorosis by the application of ferrous sulphate in trees and woody shrubs are reported from many quarters. The *Revue de Viticulture* reports the following methods: Holes about half to $\frac{3}{4}$ inch in depth were made in the trunk or large branches with a punch: a paste made by mixing 35 to 40 grams of powdered ferrous sulphate with 20 grams of olive oil was filled into the holes by means of a syringe. Within a week after the treatment the parts of the plants above the holes became quite green and the greenness was also persistent. This experiment was conducted on pear trees and Carolina poplars. The quickness of the result is certainly striking.

The *Journal of Agricultural Research* reports of a spray of ferrous sulphate of the strength of 1 % having acted favourably on nursery stock of coniferous trees badly affected with chlorosis.

In Bangalore, citrus trees of all kinds are much subject to yellowing and dropping of leaves much as though the trees suffered from Chlorosis. The newly introduced Washington Navel Oranges are especially subject to this malady. The remedy in either of the ways above mentioned may be tried.

* * * * *

“Sucre Complet”, Complete Sugar from Beets.

We read that a product much the same as our jaggery can be made out of the sugar beet, by methods almost as simple as that of jaggery-making. The juice of the beet is not subjected to the elaborate purification common in beet sugar factories nor are the molasses removed; the juice is heavily limed, heated quickly and filtered; the syrup is neutralised with phosphoric acid, and then the boiling continued to 130° C. till the stage when the syrup will set hard on taking from the fire and cooling.

It is a well known fact that the juice of the beet is quite unlike the juice of the sugarcane in that the former contains impurities of such a disagreeable character that unless they are completely removed by methods of purification, including centrifugalling to purge out molasses, the product is not fit for consumption. The beet sugar has therefore by necessity to be prepared in the highly white and pure form that we see it in, if it is to be used at all as sugar. The superiority of cane consists in the fact that the impurities in the ripe juice are not of this kind but are quite palatable. The cane can therefore be chewed for the juice: and the juice itself can be manufactured into all grades of sugar, from the crude product jaggery from which few or none of the impurities are removed,

through all grades of raw sugar containing varying amounts of adhering molasses up to the whitest sugar equal to the best beet sugar, all these qualities being eminently fit for consumption.

It is however now claimed for this new beet jaggery or "complete sugar," that as prepared by the method described, it is quite fit for eating. In fact the further claim is made that it is sweeter than white sugar and that it is of greater nutritive value, claims which many people make for jaggery as against sugar, even in the case of sugarcane.

* * * * *

Sulphate of Ammonia Manuring for Sugarcane.

One of the items of district work which promises to go forward with much responsive co-operation from our ryots is the popularization of Sulphate of Ammonia manuring for sugarcane. During the past two seasons Sulphate of Ammonia has been supplied to ryots in small quantities, free of cost by the Department so that they could see the striking effect of the manure on their own sugarcane crop. In addition to this piece of what may be called demonstration work, during the current season — experimental plots have been laid out in several villages in order to get accurate results; in this work, of course, members of our Union have taken the larger share; the experiment is designed with a view to determine to what extent the use of Sulphate of Ammonia as a small supplemental dose — at the rate of 250 lbs. an acre — in addition to the usual oil-cake manuring given by our ryots will be profitable.

The effect has been so striking throughout that we have received from practically every person to whom a free supply of small quantities for trial were made, requests that enough may be got out and sold to them, for application to their whole sugarcane crop. We have had occasion to inspect many of these trial areas and can well see that these ryots have good reason for their keenness in this respect. Even on cane of normal growth, the effect can readily be seen; while where cane has been backward, the effect is striking. Results from our members' plots as regards the actual yields will no doubt be forthcoming at the end of the season and may be expected to further increase the popularity of the manure. The District Board of Bangalore actively co-operated in this work by voting a sum of Rs. 100 to be spent on a free supply of the manure for demonstration purposes. We only wish that the price of the manure was not so very high as it is at present, for otherwise we could expand the work largely so as to benefit a much larger number of cane-growers in the State.

SELECTIONS.

I

Fine Soil more fertile.

If two spoonfuls of sugar were stirred in one cup of tea, and two lumps of sugar, containing the same amount of sugar, were stirred in another cup, the two spoonfuls of loose sugar would dissolve much more rapidly than the two lumps, because they offer a much larger surface upon which the hot tea may act. The same is true of a soil, and it is for this reason that a fine soil is more fertile than a coarse one. Cultivation makes the particles of soil finer, and more surface is thus exposed, so that the water in the soil may more readily dissolve the plant food contained therein and make it available for plants.

A plant cannot make use of food except in solution. There are several agencies of solution, among them being moisture in the soil, the soil-micro-organisms, the action of earth-worms, soil acids, and the effects of weathering. However, one point in particular is important, namely, that more plant food can be dissolved in a given time in proportion as the particles of soil are made fine, because the finer they are, the more surface is presented to the various agencies which bring plant food into solution so that the plant may use it. All of which emphasizes the great importance of thorough cultivation - *The Canadian Countryman*.

II

Nitrogen Losses in Urine.

More than half the nitrogen of farmyard manure is contained in the urine, hence the interest of the research undertaken by the authors on the losses of nitrogen in the urine of farm animals, more especially because many agriculturists usually keep the urine in tanks until the time when it is sprinkled on the fields. The expediency of keeping the liquid portion of the manure in this way having been much debated, the authors investigated the losses of nitrogen from urine :—(a) exposed to the open air ; (b) in Bunsen valve flasks ; (c) in closed flasks ; (d) in closed flasks but with the air replaced by carbon dioxide ; (e) absorbed in litter (replaced for the experiment by filter paper) ; (f) covered with

a layer of kerosene. These experiments showed that urine exposed to the air lost over 92 % of its nitrogen in 8 weeks under temperatures averaging 38° C; under temperatures averaging 5° less the same loss took place in 12 weeks. Urine not exposed to air lost on the other hand little or no nitrogen. Regarding the method of preventing loss of nitrogen by absorption in litter the effectiveness depends on the manipulation; when the litter was allowed to dry there was a loss of 20 % of nitrogen but when it was kept moist the loss was 97 %—the maximum observed in the different experiments. The use of kerosene for covering the urine is a good means of preventing loss of nitrogen, for in this case the losses were not greater than 9 % during 8 weeks. *International Review of the Science and Practice of Agriculture, February 1920.*

III

The Origin of the South-West Monsoon.

It has generally been held that the south-west monsoon owes its origin to the great difference of temperature which exists during the summer months between the heated land surface of India and the surrounding oceans, the general idea being that the warm air over the lands rises, and damp air from the sea flows into India to take its place, thus resulting in the strong south-west winds, the rainfall itself being due to the cooling of the air as it rises over India.

This theory has to face the difficulties that the temperature over India is much higher in May, before the monsoon sets in, than it is during the monsoon itself; that the temperature is higher in years of bad monsoon than in years of good monsoon; and that the part of India which has the highest temperature and the lowest pressure and where ascending currents should be the greatest, is a region of practically no rainfall throughout the monsoon.

The true explanation of the south-west monsoon can be obtained only by taking a wide view of the weather conditions over large parts of earth's surface during the summer months in the northern hemisphere. It is then seen that the south-west winds are not due to the temperature in India, but are a relatively small part of a general circulation of the atmosphere caused by a region of high pressure over the South Indian Ocean and a region of low pressure which extends over the whole of Central Asia. Air passes northwards from the region of high pressure as the south-west trade winds so far as the equator where it gets caught up in the circulation around the low pressure over Asia. On account of

the particular arrangement of sea and land, combined with deflection of wind currents due to the earth's rotation, this air travels for 4,000 miles over the sea before it reaches India, where it arrives in a very warm and exceedingly humid condition. This air, however, would probably sweep right across India to its goal in Central Asia without producing much rainfall if it were not for the unique distribution of mountains around India. From the north of Mokran coast, right round India, following the line of Afghanistan, the Himalayas, and the mountains of Burma, there extends an unbroken wall of mountains nowhere lower than 5,000 ft., standing directly athwart the air-currents. The mountains catch the air, which is being driven by a pressure distribution extending from the Southern Indian Ocean to the centre of Asia in a kind of trap, out of which there is no escape except by ascension. The damp, humid air which begins to rain as soon as it rises 500 ft., is forced to rise between 10,000 ft. and 20,000 ft., and, in consequence, large masses of water are precipitated over the greater part of the Indian area.—*Nature*, Vol. 107.

IV

The Coir Industry on the Malabar Coast.

Coir fibre, one of the products of the cocoanut is a flourishing cottage industry on the Malabar Coast. This is extracted from the outer rind or husks of cocoanuts, but the major portion of husks available is burnt away as fuel, as usually every part of agricultural produce unfit for food and fodder finds in villages a ready place at the fireside. This wasteful burning may be chiefly due to the fact that good fibre can only be had from middle ripe nuts. While the latter fact seems to a certain extent true, it has been found that fibre obtained from ripe cocoanuts, although much inferior, can be turned to account and it appears that a large quantity of ripe nuts are exported to Europe and the coir for ropes, etc., separated on arrival. The Great War also has had its telling effect on this industry and the exports of coir fibre and coir yarn fell from 746 tons and 386,100 lbs. in 1913-14 to 300 tons and 150,000 lbs. in 1918-19. The trade in coir rope is great but internal, and 2,717 tons of this stuff were available for export.

The industry is more or less confined to the coast since situation contributes much to the quality of the fibre and the fibre would seem to become coarser at a distance from the coast. The yarn is mostly hand-spun and sometimes wheel-spun and the wages for making a

stout Mhote rope of 25 lbs. of fibre is twelve annas and for a tail rope four annas.

The method of manipulating and of removing the fibre is as follows:—The husks of cocoanuts are buried in the marshy places of beds of rivers called 'Ghaznis' and are allowed there to remain and rot for six months. Fresh water is said to be injurious for this purpose. After six months, they are removed at the commencement of the rainy season. They are then beaten down with a wooden hammer and dried in the sun for a day or two. The yarn is then separated, dust being thrown away, and is then twisted into ropes. A woman can beat out 25 lbs. of coir fibre per day. A piece of cord about $2\frac{1}{2}$ yards in length is tied up into a bundle and 100 of these bundles make a big bundle. Nearly 250 such big bundles weigh a ton. About 10,000 to 12,000 cocoanut husks yield a ton of coir which is always sold in weight in wholesale transactions.

Of the several processes detailed above, the twisting is done by females and children and the industry is in the hands of Mapillas, a class among Mahomedans, and by the depressed classes. The cost of preparing a ton of fibre and rope therefrom is about Rs. 60—70.

The uses which the coir fibre is put to are too many to be enumerated in detail. Long fibres are used for mats and spinning; the shorter for brush, broom 'bristle' and the curled fibre for upholstery. Coir rope is especially serviceable in India because it does not suffer from the damp climate.

In this connection it should be noted here that, in separating the fibre, the dust obtained is thrown away, but this refuse has its own value and demand. Under high pressure the dust is found to make a rather brittle card-board.

The chief markets for coir fibre and ropes are Cochin, Calicut and Mangalore and the price of coir fibre ranges between Rs. 150 to Rs. 200 per ton: of yarn Rs. 150 — 300 and of rope Rs. 180 — 300 according to the quality and fineness.—*The Indian Scientific Agriculturist, January 1921.*

V

Bud Variations in Sugarcane and their Use.

The author studies these bud variations as starting points in the creation of new kinds of sugarcane of commercial value, following the example of numerous kinds of orange, cotton, etc., similarly obtained.

These bud variations, which have previously been studied in Louisiana (United States), in the West Indies, in Mauritius and in Australia, may be grouped in the following manner :—

I. *Canes Bearing Shoots of a Different Colour.*—Two cases may be met with : (a) Striped canes producing variations of plain colour ; (b) Canes of plain colour producing striped variations.

(1) The variety "Striped Tanna," introduced long ago into Mauritius often produces two bud variations, one plain yellow called "White Tanna," and the other purple, called "Black Tanna."

In 1910 the former was cultivated largely in Mauritius and in the Hawaiian Islands (unirrigated plantations) under the name "Yellow Caledonia" and in the Fiji Islands under the name of "Malabar."

The variety "Red Cheribon," striped yellow and red, has produced by bud variation, two kinds of plain colour "White Cheribon" (pale) and "Black Cheribon" (dark).

(2) The variety "Louzier," plain yellow (produced by a mutation of the striped red and green kind "Mignonne") was able to produce, by bud variation, kinds regularly striped green and red (like "Mignonne,") and kinds irregularly striped green, red and yellow.

II. *Rhizomes producing shoots of different colours.*—Melmoth Hall mentions the case of a rhizome of the Ribbon variety which, along with normal Ribbon shoots produced also shoots which were entirely yellow and others entirely green.

III. *Stalks with some internodes striped and others of plain colour.*—In New South Wales (Australia), James Clarke found a cane of "Striped Tanna" variety whose lower internodes were striped (normal) while the upper internodes were plain yellow ("White Tanna" type).

IV. *Origin of Types characterized by great vigor and richness in Sugar.* In Mauritius alone there are eight or nine kinds of sugarcane raised by bud variation ; some of them cultivated on a large scale are superior to the original types in strength and yield of sugar. These new varieties came from kinds recently introduced into the island, and it is probable that they are due to this change in environment, which would have influenced the habit of the plants.

The types produced by bud variation transmit, agamously, to their decedents their good and bad characters without alteration. It goes without saying that we can profit by this fact in efforts to improve sugarcane, but on the other hand it is necessary to select the reproductive material very carefully and prudently, so as to avoid the propagation

of types of little value. A good many of the kinds of sugarcane widely cultivated owe their origin to bud variation. This is noticeably the case of the "Louzier" variety produced in Mauritius about half a century ago by a mutation of the variety "Mignonne" (described above) and which several writers consider identical with the varieties Yellow Otaheite, Bourbon and Lahaina; it has now spread over all tropical regions from Mauritius to the Dutch Indies, Cuba, the West Indies and the Hawaiian Islands.—*The Louisiana Planter and Sugar Manufacturer*, April, 1921.

VI

The Selection of *Hevea brasiliensis* according to individual differences.

I. These are the results of a series of observations made in the Federated Malay States on the specific differences in the amount of rubber yielded by individual trees of *Hevea brasiliensis* of the same age and growing under the same conditions, in order to establish also whether there exists a correlation between the yield and girth of the trunk. Some 1,000 trees, 7 years old, in a normal plantation covering 13 acres, were carefully studied, the trees being in their third year of tapping.

Great variations were found in the rubber content of the latex (the "strength" of the latex) from different trees, and appeared to be constant from year to year. Some trees yielded 23 gm. of rubber per 100 c.c. of latex, others as much as 54 to 55 gm. per 100 c.c. of latex, the mean for the 245 trees examined: latex increases as the trees grow older, to the extent of 1 — 2 per cent per annum.

The author admits the possibility of obtaining good positive results from selection based entirely on individual variations: if high yielding trees can be segregated and provided that pollen of poor-yielding trees can be prevented from gaining access to the flowers, it should be possible to get seeds capable of producing trees with a high percentage of rubber in the latex. There is a definite correlation between girth and yield, but it is not sufficiently well indicated to be of great value in eliminating trees from a plantation.

II. In *Hevea* plantations there are good and bad yielding trees. For 5,000 trees, 8-9 years old, the main daily yield of latex was 22 c.c. Eighty per cent of these trees gave on the average 10 c.c. while the remaining twenty per cent alone produced 65 per cent of the entire yield. It is to be inferred from these results that productivity is a hereditary character.

On the other hand, in plantations, free cross-pollination mixes good and bad elements in the most varied of genetic combinations, while complete segregation of the best specimens involves very great difficulty from the technical and practical point of view.

The author urges the suitability of vegetative propagation of the best yielding trees, by grafting on to the young plants slips from specimens that have been under careful and continuous control and are notable for their high yielding properties.

It is a case of repeating with *Hevea brasiliensis* that which is being tried at present with coffee and cacao in Surinam and has already been carried out on a large scale in the United States citrus plantations.—*International Review of the Science and Practice of Agriculture*, February, 1920.

VII

The Arrowing of the Sugar-cane.

Under the above title there has been much debate in relation to this physiological development of sugarcane. In Louisiana, just without the border of the tropics, sugarcane rarely ever arrows, but does arrow to a limited extent at rather long intervals. We may say that the growing bud or top of the sugarcane in favourable seasons when split open will show an immature arrow or blossom, quite frequently, say, as often as every 6 or 7 years. Mr. G. A. La Barthe, in the Bulletin of the Sugar Chemists of France, recently published an essay on this subject from a free translation of which we would recite a few points: The causes of premature arrowing were said to be very diverse and contradictory. Some have explained the more common phenomenon with the statement that reproduction by means of seedling cane has caused a modification in the formation of the flower at the time of the cane maturity. This is contradicted by the fact that some plants have reproduced through seedlings for centuries and have kept a normal flowering. It is said that insufficiency of soil food or the lack of fertilization and in general all circumstances that keep back the growing of the cane, favour flowering, or arrowing. The conclusion from this is that the cane should be fortified during summer by supplying nitrogen in a simple form such as nitrates dissolved in irrigation water.

Another theory is that the flowering is favoured by a strong vegetation and mostly through an excess of nitrogen in the soil, the

consequent remedy being to use all possible means to check vegetation ; no irrigation and less nitrogen.

But none of these theories explains the flowering of cane in the different circumstances in which it is met. Mr. LaBarthe's observations were made on fields of fifteen or sixteen thousand acres of land under different climate conditions and comprised soils of different composition. These led him to consider that flowering was a consequence of a disproportion of the amount of moisture absorbed by the roots, and that evaporated through the leaves. This causes the sap to ascend more slowly, and then nature tries to bring back the equilibrium by giving forth new organs of evaporation which at the same time assures the reproduction of the species. From these data we see that the reasons for bringing about either too much absorption by the roots, or not enough evaporation by the leaves will favour arrowing.

It is known, of course, that the water is produced by the protoplasm and the chlorophyl functions cover the whole surface of the cuticle, but mostly through the stomata. At the beginning of the summer the soil lacks water, and if to the effects of high temperature there be added that of the wind and sudden changes in the hygroscopic state of the atmosphere, then the cellulose cuticle gets thicker and the stomata diminish in number and in efficiency, and the evaporation becomes insufficient. The plant then tries to get new organs of evaporation to make up for the old ones that are no longer sufficient to remedy this condition by irrigation, and the results of this might be favorable or not according to the development of the roots. If they are too developed through a lack of nitrogen, then they absorb too much water and arrowing is hastened. If, on the contrary, the growth of the roots has been normal, the vegetation is normally resumed after a while.

So the observations of Mr. LaBarthe have led him to the following conclusion. An excess of moisture in the soil favours arrowing, and the more developed the roots are and the less developed the evaporating organs are the quicker is the phenomenon produced.

As for the effects, the opinions are more at variance even than for the causes. Boname has observed that, as soon as the flowers appear, the sucrose content ceases going higher. Then Venderghem comes to the same conclusion, remarking that the cane then contains more fibre and less juice. The South African Journal gives some observations in which the arrowed canes give a juice of a lower sucrose content and containing more glucose while the crop diminishes in weight, and the percentage of juice also becomes less.

This led to a conclusion applicable to the tropics that one should select a non-arowing species, and plant closer; to use nitrogenous fertilization and to drain away any excess of water.—*The Louisiana Planter*.

VIII

Cattle Insurance.

Mysore Government Order 5621--34 A. & E. 132-16-20, dated 20th December 1920.

The question of introducing a scheme for cattle insurance in Mysore has been for sometime under the consideration of Government. A scheme based on co-operative lines has been introduced in Burma, Coorg and the United Provinces and is reported to be working with a fair measure of success. The Agricultural Board recommends the establishment of six Co-operative Societies on the Burma Model experimentally. The main features of the scheme as worked in Burma are as follows:—

(a) Insurance is confined to plough cattle and the operations of the Society are restricted to a single village.

(b) The maximum amount for which a cattle insurance society can insure any animal is limited to Rs. 100.

(c) Indemnity is given in the case of loss due to death from disease or accident.

(d) The premium payable is 5 per cent of the value of each animal insured payable in advance in 2 instalments once in six months.

(e) The indemnity payable for each animal is $\frac{2}{3}$ of the value of the animal less the amount realized by the owner of the animal by the sale of skin or meat or both.

(f) The Society may re-insure up to a half of its risks with a re-insurance society or a Joint Stock Company approved by the Registrar.

(g) The valuation of the animals is to be made by three experts selected from the Committee of Management constituted by the general body of the Society.

Government approve of the proposal to start six Co-operative Cattle Insurance Societies to be worked on the lines indicated above with the following modifications:—

(i) The premium payable will be $1\frac{1}{2}$ per cent of the value of the animal insured.

(ii) The maximum amount of indemnity will be fixed at Rs. 100.

It should be made clear to each society that the scheme should be worked on strictly co-operative lines.

As regards financial aid that may be needed by such societies, the Registrar of Co-operative Societies, who was consulted in the matter is of opinion that some Government assistance would be necessary in the earlier stages and that it would have to take the form of guarantee of financial support up to a limit of Rs. 2,500 in the case of each society. In view of the fact that it is not likely that other central financial agencies will undertake to advance loans to this new and novel form of co-operation, Government will be prepared to finance each of these societies to the extent of Rs. 2,500 if and when required. This advance will be recovered in ten annual instalments with interest at $6\frac{1}{2}$ per cent per annum. The Registrar is requested to frame and submit for the approval of Government rules laying down the conditions subject to which such loans may be granted.

As the success of the scheme will in the initial stages greatly depend upon the facilities the Department of Co-operation and the Civil Veterinary Department can provide for prevention of losses by diseases and for the efficient management of the societies, the Registrar of Co-operative Societies is requested to organize such societies in suitable places to be selected in consultation with the Director of Agriculture and within easy access of responsible officers belonging to both departments.

Government do not consider it necessary to appoint a separate Veterinary Inspector solely for supervising these societies. The Director of Agriculture will, however, be requested about necessary instructions being given to Veterinary Inspectors to visit any Cattle Insurance Society that may be situated within five miles from their headquarters once at least a week and render such assistance and advice as may be required of them.

The Registrar of Co-operative Societies is requested to frame a set of model bye-laws to regulate the working of such societies in consultation with the Revenue Commissioner and the Director of Agriculture and to submit a copy of the same for the approval of the Government.

The Revenue Commissioner, the Director of Agriculture, and the Deputy Commissioners of Districts are requested to instruct the officers of their respective departments to co-operate with the Registrar in working the scheme on successful lines.

IX

Results of Crossing the Zebu with European and Australian Cattle, in British and Dutch India.

In tropical colonies, repeated attempts have already been made to cross *Bos taurus* with the Zebu, so as to combine the beef producing capacity and productivity of the former with the adaptability of the latter to the local conditions and its special resistance to disease.

The author describes the results of a series of crosses between the Nellore breed of Zebu on the one hand and the Java ox and some European and Australian cattle on the other hand.

The Zebu of Nellore (Madras, British India) is an excellent working animal: it measures 1.40 to 1.50 metres at the withers: the female gives a high yield of milk, 8-10 litres per day with a fat content of 4.5 to 5 per cent. From the cross Zebu x Java cattle, draught types were obtained but they were poor milkers. By crossing Nellore Zebus with Australian or Dutch cattle, animals were obtained which gave a good production of beef and a milk yield which, although less than that of their European dams, was nevertheless above that of the Zebus, and such as to make these hybrids of great value in the warm damp coast regions of the Dutch East Indies. The fat content of their milk is 1% and even over. The castrated males make splendid draught animals, the author mentions a pair (sold on the Malang market) which measured each 1.50 metres in height and 2.20 metres round the chest.

By using as sires, in these crosses, males of European breed, the Zebu characteristics quickly disappear, and in the 3rd generation the progeny cannot be distinguished from pure-bred European cattle.

The importation of bulls and dairy cows from India, Europe and Australia is regulated by the State. The European and Australian types concentrated in the central mountainous territory, where the altitude moderates the temperature and keeps it between 15° and 30° C., can become acclimatised and breed regularly.

The results already given by scattered and un-co-ordinated attempts promise the best of prospects for the future, especially when the work is carried on according to a uniform method and with a well-planned programme of work.

The example of British India gives an idea of the results that can really be obtained by the crosses in question. The Montgomery (Zebu) cow has been mated with the Ayrshire bull, with a view to raising the milk yield of the Zebu type. While the Montgomery cow yields on an

average 8-10 litres of milk per day, at the second generation of the cross a daily yield of 15 litres has been attained.—*International Review of the Science and Practice of Agriculture, February, 1920.*

X

Weed Control and Fertilization.

Where cane fields have been cultivated and weeds eradicated from them for many years, as in Barbados, the benefits of applying fertilizers are well known. In some of the other islands, where from lack of labour such complete cultivation has not been possible, the application of artificial manures has not always seemed to be advisable. In "Facts about Sugar", January 24, 1920, an interesting account of an experiment in Hawaii with regard to weed control and fertilization is recorded. As this question is of general interest to cane planters, most of the article is reproduced below :—

This was a test to determine the effect of weed growth on the growth of cane, and to determine the value of fertilizing in the presence and in the absence of weeds. The experiment was planned by L. D. Larsen and R. S. Thurston, and carried out by the latter. The experimental cane was D-1135 planted, on a non-irrigated field. The plan of the experiment was as follows :—

Plots.	No.	Treatment.
D	12	Weeds allowed to grow ; fertilizer.
E	12	No weeds ; fertilizer.
F	8	Weeds allowed to grow ; no fertilizer.
G	8	No weeds ; no fertilizer.

In the D. and F. plots weeding was done approximately as in the surrounding field, and at times the weeds were very bad. The E & G plots were kept free from weeds, either by cultivation, hoeing, or spraying.

The cane in this field, for some reason, died back to a large extent ; on this account the juices were very poor. The cane was sampled in cart-load lots at the mill, and the juices composited for each treatment. It took about 15 tons of cane per ton of sugar. The results of the harvest were as follows :—

Plots.	Cane.	Q.R.	Sugar.
D	21·31	15·46	1·38
E	29·37	15·69	1·87
F	13·19	14·89	0·89
G	20·38	13·28	1·53

These results are very striking, in that they show that the weeds in this case, completely overcame the beneficial effects of the fertilizer: that is, the plots having no weeds and no fertilizer produced slightly more sugar than did the plots receiving fertilizer without perfect weed control.

Weed control produced as great gains as did fertilizing, if not greater.

The D & E plots received the same amount of fertilizer: in addition to this, the E plots had perfect weed control and produced 8 tons of cane more than the D plots.

Comparing the D & F plots where weeds were allowed, we find a gain of 8 tons of cane, due to fertilizing, in D. In this case either weed control or fertilizing produced a gain of 8 tons.

Further study shows that these gains are accumulative, weed control and fertilizer (E plots) produced 16 tons of cane more than no weed control and no fertilizer (F plots).

These results are very important, as showing that full advantage cannot be taken of heavy fertilizing unless weed control is carried out also. They also seem to indicate that, in times of acute labour shortage, the loss can be partly made up by fertilizing unless fertilization is already high.—*The Planters' Chronicle*.

XI

Economic Conditions of Power Farming.

All the mistakes made in power farming are due to the fact that the inventors and makers of power farming machinery were not sufficiently well acquainted with agricultural science and did not know how to adapt mechanics to the needs of cultivation. The author considers the economic conditions which any power farming machine should obey and thus enters into the field of farm management, which is derived from agricultural practice.

The best "mechanical" solution of the problems of mechanical cultivation and cultivation in general would be to have a special machine for each kind of work. This solution may be said to be found, for there are excellent machines suitable for definite classes of work (windlasses for digging work, 20 to 40 H.P. tractors for average ploughing, small tractors of the Mesmay type for light work, cultivators of the Meyenbourg type for breaking up the soil in spring, etc.). But were all these machines to be used on one farm, even of great extent, it would mean financial collapse owing to the depreciation, as each of the machines only

works for a short period in each year. From the economic point of view the ideal would be the "single" solution, representing a limited depreciation, the depreciation on one machine being the smaller the more it is used. It is advisable, therefore, to procure machines having varied uses and which can do most yearly work. At the present moment, tractors and particularly windlass-tractors and wagon-windlasses, best supply the want. The future solution seems to be electrical, a regional central station distributing current along the chief communal lines from which branch lines that supply electric motors.

The economical use of power farming also depends on the area and the form of the divisions of the farm. There is no need to exaggerate the difficulties met with by motor-culture in farms that are much divided but the evil remains and the cost of the work is greatly influenced by it. Contrary to the wide-spread opinion there is no reason that power farming should be restricted to large farms. The only restriction on the use of tractors in small areas rests in the choice of the machine. Only small, very handy, low-powered machines can be used in this case. In order that power farming may develop to the fullest extent, farmers and farm labourers should be given a better mechanical training or, at any rate, what training they have should be improved upon.

The author next deals with the value and future of power farming as regards its relations with animal power. The mechanical motor is not required to replace the animate motor completely. If motor-culture brings about an increase of yield, it will lead to an increased need of teams for the work that falls exclusively to them. A certain number of draught animals have to be retained for certain work and, between them and tractors, there is an economic equilibrium that is very hard to obtain. It seems, however, that this vicious circle can be avoided up to a certain point by the almost exclusive use of oxen as draught animals, for they can rest without any disadvantage: their maintenance ration has a minimum cost, when it is exceeded they "make meat" and, for industrial farms, they are practical consumers of cumbersome residues (pulps, etc.).

Mechanical traction has certain marked advantages over animal traction. It is above all the theoretically unlimited power that can, so to speak, be condensed in a single machine, whilst with animal traction, the number of animals in a single team cannot be increased.

The power of inanimate motors can be utilized in different ways:

(1) by increasing the tractive effort to the detriment of the speed for very heavy work (grubbing, deep ploughing, etc.);

(2) by maintaining a minimum speed: the corresponding maximum tractive effort can be utilized by towing implements working at a slight depth, but over a large surface.

(3) by increasing the speed of traction to the detriment of the pull measured at the draw-bar.

But, on the other hand, the inanimate motor is less supple, it has less elasticity as to power and not such a good grip on the land as animate motors.

The author gives the economic and agricultural characteristics of the different inanimate motors (steam, internal combustion and electric) and the economic and agricultural characteristics of the different ways of utilizing motive power in the field as a tractor or windlass. Each type has its good qualities and defects: thus it is not surprising that in seeking mixed solutions types of machines have been proposed that are also different from those seen of recent years, and the development of power farming has not attained such a degree that it is as yet possible to decide clearly in favour of any particular proposed principle or system.

The author next deals with the influence of substituting mechanical for animal traction on agricultural technique: on (1) manuring, (2) crop rotations, and (3) yields.

(1) Organic manures will diminish in quantity and the author thinks that the solution of the problem from this point of view lies in the generalization of the wide-spread methods of "cultivating without manure" based on the rational utilization of the inexhaustible nitrogenous resources that Nature provides through the medium of the Leguminosae.

(2) One of the consequences of this is the development of forage crops in the rotations (which, besides, require little labour). The forage produced is used primarily for the farm stock, the remainder being sold off the farm or used as green manure.

Oat-growing will lose its importance and that of wheat will increase. Beet-growing may possibly develop, which is desirable for the use of alcohol as a fuel.

(3) Most of the results obtained up to the present agree in showing that mechanical cultivation clearly results in increased yields. This is due to the following reasons: Work done with more powerful means can be better done, work can be done that would otherwise be neglected and all the work can be done quickly in the desired time and when the soil conditions are favourable.

Labour is decreasing everywhere in quantity and quality : recruiting will be more easy with power farming.—*Annals de la Science Agricole XXXV, Nos. 1—3.*

XII

Note on cultivation of yams (*Amorphophallus campanulatus* and *Typhonium Trilobatum*) in and round Sivakasi, Ramnad District.

These two yams known in Tamil as “Kara Karnai” and “Karanai” have earned much repute and are sent to the Madura and Tinnevely markets in large quantities.

The season for these yams commences in April and lasts till about the beginning of December and they are full eight months’ crops.

Soil and preparatory cultivation.—The garden lands here are clay loams and red sandy loams, sufficiently deep. These crops are grown only on red sandy loams 12 to 15 inches deep underlain with gravel which shows that the land is not lacking in drainage facilities. The lands are ploughed several times in summer, deep with country ploughs weighted with stones. The field receives six ploughings. Sometimes the clods are broken with wooden mallets also to render the soil mellow.

Manure and Manuring.—The manure that is applied generally is well rotten cattle manure and house-sweepings, and a heavy dose of 100 to 120 cart-loads an acre is given. The crops require heavy manuring, the term cart-load is to be understood only as of one cart having side planks of 18” height. Even this manure is very difficult to get and costs Re. 1 a cart-load. Sheep-penning at 1,000 sheep an acre is resorted to for supplementing cattle manure, when sufficient quantity is not procurable and this costs Rs. 7-4-0 including the wages of a watchman. When sheep are penned 80 cart-loads of cattle manure are applied. But this mixture does not result in a satisfactory yield and therefore at any cost cattle manure and village rubbish are bought at however high a rate. Naturally therefore this forms an important item in the cost of cultivation. This over, bed forming is taken up.

Planting.—Beds $1\frac{1}{2} \times 1\frac{1}{2}$ yards are made and irrigation channels formed and planting commences by about the 15th of April. The Elephant yam corms are cut into pieces and planted two feet apart either way, and the whole corm of the other yam are planted at a distance of $1\frac{1}{2}$ feet each way. The corms are cut for planting the previous night and smeared with ashes. The Elephant yam is planted at a seed rate of 20 pothies (8,940 lbs.) per acre and the other at 10 pothies. Soon after corms are planted, watering commences,

Irrigation.—This is given once in 5 days during the first two months, when corms begin to sprout. The land is kept scrupulously clean of weeds. After sprouting, irrigation is given once a week or in 10 days, and ends with that at once in a fortnight. But interval between waterings varies with weather conditions.

After-cultivation.—This consists in weeding and hoeing. The beds are kept quite clean till the crop covers the ground and the ryots bestow their best attention on this operation and no top-dressing of manures is resorted to.

Harvesting.—By the 15th November or the beginning of December the leaves put on an yellow appearance, which indicates that the crop is ready for harvest. Digging out corms continues till the end of November and when weather does not permit and lands are wet, as late as the middle of December. The corms are dug with 'mammatti' by men, and women coolies lift them out and clean them. The corms are then ready for the market, and are sold on the spot. The outturn varies from 100 to 200 pothies an acre.

Diseases and insect enemies. The crops have rarely been suffering from any insect pest or disease. *The Journal of the Madras Agricultural Students' Union, Vol. VIII, No. 7.*

XIII

Indian Agricultural Service.

The following are the rules regarding the emoluments and conditions attached to appointments in the service as recently revised by His Majesty's Secretary of State for India.

1. The appointments in the Indian Agricultural Service include those of Deputy Director of Agriculture, Agricultural Chemists, Economic Botanist, Mycologist, Entomologist, Bacteriologist, Professors of Agriculture, Chemistry, and Botany at Agricultural Colleges, and the like. Some of these are included in the Imperial Department of Agriculture under the direct control of the Government of India, but the majority are included in the Departments of Agriculture of the several provinces of India. In some cases candidates will be appointed direct to these posts but in most cases they will undergo a further course of training in India in Indian Agriculture, and will be appointed to posts, for which in the opinion of the Government they are considered suitable, on the regular establishment as vacancies occur.

2. Appointments are made by the Secretary of State for India as occasion may require, and enquiries regarding them should be addressed to the Revenue Secretary, India Office, London, S. W. 1. Applications should be submitted upon the printed form provided for the purpose.

3. Candidates must, as a rule, be not less than 23 nor more than 30 years of age. Exceptions will be made as regards the maximum limit only in the case of appointments requiring special qualifications. Candidates must furnish evidence of having received a good general education, and of possessing a thorough knowledge of the science of Agriculture or of the particular science required for the appointment applied for. Preference is given to distinguished graduates of Universities in the British Empire. Every candidate must be a natural born British subject, and at the time of his birth his father must have been, and must since have continued to be, a British subject, but the Secretary of State for India reserves the power to relax this rule in special cases.

4. Preference will be given to candidates who have served in His Majesty's Forces during the war, completed years of such service rendered after the age of 23 will, subject to a maximum of four years, count for pay, promotion, and pension, but not for leave.

5. Candidates whose applications are selected for consideration will be required to present themselves for an interview at the India office at their own expense. In selecting candidates for appointment to administrative posts (those of Deputy Director of Agriculture), weight will be given to the possession of (a) a University degree in honors in science or the diploma of a recognised school of agriculture or other like distinction; (b) practical experience of farming. Candidates for research and teaching posts must possess a University degree or other similar qualification in the special science concerned and preference will ordinarily be given to those who have spent a period of two years in research work under a scientist of established reputation and have studied the science from an agricultural point of view. Importance is also attached to bodily activity and ability to ride, and selected candidates are required to undergo an examination by the Medical Board of the India Office as to their physical fitness for service in India.

6. Newly appointed officers are required, before leaving this country to enter into an agreement with the Secretary of State embodying the conditions of their appointment. They are provided at the expense of Government with a first-class passage to India, the cost of which they will be required to refund if they voluntarily relinquish the service of

Government before the close of three years from the date of appointment. If any officer's service be determined at the expiration of the term he be compelled by ill-health (certified to the satisfaction of Government) to give up the service, a first class passage to England will be provided at the expense of Government. Pay commences from the date of arrival in India.

7. An officer appointed to the Agricultural service will be on probation in India for three years. He will be required to pass an examination in a vernacular language within such period after his arrival in India as the Government of India may prescribe. His appointment may be cancelled for failure to pass this examination, or any time for unfitness or misconduct. At the end of his three years' term of probation the Government of India will decide whether to retain or dispense with his services.

8. Officers of the Agricultural Service are expected to give their whole time to the duties of the service, and are liable to transfer from one appointment or province to another.

9. The monthly salary attached to posts in the Indian Agricultural Service is as follows :—

Years of service	Pay Rs.	Overseas pay Rs.	Total Rs.	Years of service	Pay Rs.	Overseas Pay Rs.	Total Rs.
1	350	150	500	15	950	250	1,200
2	400	150	550	16	1,000	250	1,250
3	450	150	600	17	1,050	250	1,300
4	500	150	650	18	1,100	250	1,350
5	550	150	700	19	1,150	250	1,400
6	550	200	750	20	1,200	250	1,450
7	600	200	800	21	1,250	250	1,500
8	650	200	850	& onwards			
EFFICIENCY BAR.							
9	700	200	900		1,250	250	1,500
10	750	200	950		1,300	250	1,550
11	800	200	1,000	Selection Grade	1,350	250	1,600
12	800	250	1,050		1,400	250	1,650
13	850	250	1,100		1,450	250	1,700
14	900	250	1,150		1,500	250	1,750

Free quarters are not provided.

The overseas pay is admissible only in the case of officers of non-Indian domicile.

Officers are eligible for promotion to the selection grade as a reward of merit after completion of 15 years' service. This grade is limited to 15 per cent of the Imperial Services. Officers on the provincial cadres

are also eligible for Directorships of Agriculture on a scale of Rs. 2,000-50-2,250 a month, and for the post of Agricultural Adviser to the Government of India, which carries a salary of Rs. 2,250 a month with a rent-free house at Pusa.

10. Officers holding appointments of Heads of Sections at Pusa, or other permanently sanctioned posts in those Sections, receive local (or Pusa) allowances. These are classified as duty allowances, and, as such, count towards leave allowances and pension. The normal allowance is Rs. 150 a month, but Heads of sections receive Rs. 200 a month, which, on completion of 15 years' total service, is increased by annual increments of Rs. 10 a month, subject to a maximum of Rs. 400 a month. Officers of less than three years of completed service or on a scale of pay less than that of an officer in his fourth year of service under the normal time scale are not entitled to Pusa allowance.

The grant of local allowances is, in each case, conditional on approved service, and the Government reserves to itself full discretion as to granting, withholding or withdrawing them.

11. Principals of Agricultural Colleges receive a duty allowance of Rs. 150 a month in addition to their pay under the time scale. An officer serving in Burma is entitled to a local allowance varying from Rs. 90 to Rs. 165 a month according to salary, in addition to the other emoluments admissible to him.

12. Members of the Indian Agricultural Service draw travelling allowances for journeys on duty as officers of the first class under the Civil Service Regulations.

13. On being confirmed in his appointment a probationer will become eligible, as from the date of his arrival in India, for leave allowances and pension, under the regulations applicable to the Department. These regulations are liable to be modified by the Government of India from time to time.

14. Officers who are appointed after reaching 25 years of age may reckon as service for superannuation pension the actual period, not exceeding five years, by which their age on appointment exceeds 25 years. (The war service pension concessions referred to in clause 4 is not in addition to this pensionary concession, but officers already recruited or to be recruited will receive whichever concession is the more favourable).

15. Retirements are ordinarily required at 55 years of age, but an officer may, for special reasons, be retained after attaining that age.

(From the Publicity Bureau.)

The Mysore Agricultural & Experimental Union, Bangalore.

NOTIFICATION BY THE PRESIDENT.

The Lending Library.

Arrangements have been made recently to set apart a selection of books from the Library of the Department of Agriculture for the purpose of lending to persons interested in Agriculture and allied subjects. A list of these books has been published as No. 30 of the Departmental circulars, and reproduced below. Members who wish to avail themselves of this privilege should apply to the Director of Agriculture, through the Secretary, for the loan of such books as they may require.

The following rules relate to the issue of books on loan :—

(1) Books taken on loan are liable to recall at any time, but if not recalled, they may be kept for a period of two weeks when the borrower shall return them at his cost but may re-borrow, provided there are no applications for them. The period of loan may be extended by the Director.

(2) The number of volumes which may be taken out on loan at one time is ordinarily limited to two works subject to a maximum of three volumes.

(3) If a book is lost or damaged by the borrower he must pay the full cost of the publications.

LESLIE C. COLEMAN,
President.

Circular No. 30.

LIST OF BOOKS AVAILABLE FOR LENDING FROM THE LIBRARY OF THE DEPARTMENT OF AGRICULTURE IN MYSORE.

1. AIKMAN, C. M. —Manures, and the Principles of Manuring. Edinburgh, 1894.
2. BAILEY, L. H.—The Principles of Vegetable Gardening. New York, 1909.
3. BAILEY, L. H.—The Principles of Fruit-Growing. New York, 1911.
4. BAILEY, L. H.—Garden-Making. New York, 1908.
5. BROOKS, W. P.—Soils and How to Treat Them. Springfield Mass, 1911.
6. CAMPBELL, H. H. S.—Soil-Culture Manual. Lincoln, 1907.

7. CARD, F. W.—Farm Management including Business Accounts, etc. London, 1912.
8. CHATTERTON, A.—Lift Irrigation. Old Edition, Madras, 1912.
9. COPELAND, E. B.—The Coconut. London, 1914.
10. COULTER, J. H.—Co-operation among Farmers. New York, 1911.
11. EARLE, F. S.—Southern Agriculture. New York, 1908.
12. ELLIOT, C. G.—Practical Farm Drainage. A Manual for Farmer and Student. New York, 1911.
13. FAIRCHILD, G. T.—Rural Wealth and Welfare. Economic Principles Illustrated and Applied in Farm Life. New York, 1900.
14. FERGUSON, J.—All about Areca Palm. Colombo, 1897.
15. FLATTERS.—The Cotton Plant, its Development, and Structures of the Cotton Fibre. 2nd Edition, London, 1912.
16. FLETCHER, S. W.—Soils, How to Handle and Improve them. London, 1910.
17. FRASER, S.—The Potato. New York, 1912.
18. FREEMAN, W.—Elements of Agriculture. New Edition, London.
19. FRENCH, A.—How to Grow Vegetables and Garden Herbs. New York, 1911.
20. FIELDING, A. E. B.—Farm Management. London.
21. GAMMIE, G. A.—The Indian Cottons. Calcutta, 1905.
22. GUNN, W. D.—Cattle of Southern India. Madras, 1909.
23. HADI, S. M.—The Sugar Industry of the United Provinces of Agra and Oudh. Allahabad, 1902.
24. HAGGARD, H. R.—Rural Denmark and its Lessons, New Edition. London, 1913.
25. HAGGARD, H. R.—Rural England, Vols. 1 and 2. London, 1906.
26. HALL, A. D.—British Agriculture. London, 1917.
27. HALL, A. D.—Agriculture after the War. London, 1916.
28. HALL, A. D.—The Feeding of Crops and Stock. London, 1911.
29. HENSMAN, W.—Cattle Breeds and Management, 7th Edition. Live Stock Handbook, No. 4.
30. HOUSEMAN, WILLIAM.—Cattle Breeds and Management, Live Stock Handbook, No. 4, 7th Edition. London, 1915.
31. HOPKINS, C. G.—The Story of the Soil. London.
32. HOWARD, L. O.—The Insect Book. Toronto, 1901.
33. HUNT.—How to Choose a Farm with a Discussion of American Lands. New York, 1911.
34. INGLE, H.—Elementary Agricultural Chemistry, 1913.
35. JOHNSON, W. H.—Elementary Tropical Agriculture. London, 1913.
36. JOHNSON, S. W.—How Crops Grow. New York, 1908.

37. JOHNSON, S. W.—How Crops Feed. New York, 1908.
38. JORDON, W. H.—The Feeding of Animals. New York, 1919.
39. JOSHI, L. L.—The Milk Problem in Indian Cities. Bombay 1911.
40. KEATINGE, G.—Rural Economy in Bombay, Deccan. London, 1912.
41. KELLNER, O.—The Scientific Feeding of Animals. London, 1913.
42. KENNEY, J.—Intensive Farming in India, 2nd Edition, 1916.
43. KING, F. H.—The Soil, its Nature, Relations and Fundamental Principles of Management. New Edition, 1920.
44. KING, F. H.—Farmers of 40 Centuries or Permanent Agriculture in China, Korea and Japan. Madison, 1911.
45. KIRBY, F. W.—Elementary Text-book of Entomology. London, 1892.
46. KOESTER, F.—Electricity for the Farm and Home. New York, 1913.
47. LANKESTER, E. R.—Science from an Easy Chair. London.
48. LATTER, O. H.—On the Natural History of Some Common Animals. Cambridge, 1904.
49. LAURIE, A. P.—The Food of Plants. An Introduction to Agricultural Chemistry. London, 1911.
50. LIPMAN, J. G.—Bacteria in Relation to Country Life. New York, 1911.
51. LODEMAN, E. G.—The Spraying of Plants, New Edition. New York, 1910.
52. LYON, T. L. and FIPPIN, E. O.—The Principles of Soil Management. New York, 1909.
53. MACDONGAL, D. T.—The Nature and Work of Plants. An Introduction to the Study of Botany. New York, 1900.
54. MACMILLIAN, H. F.—A Handbook of Tropical Gardening and Planting, 2nd Edition. Colombo, 1916.
55. MANN, G.—Beginnings in Agriculture. New York, 1911.
56. MASSIE, G.—Diseases of Cultivated Plants and Trees. London, 1910.
57. MAYO, N. S.—The Disease of Animals. A Book of Brief and Popular Advice on the Care and Common Ailments of Farm Animals. New York, 1911.
58. MILES, M.—Silos, Ensilage and Silage. A Practical Treatise on the Ensilage of Fodder Corn. New York, 1913.
59. MOLISSON, J.—A Text-book of Indian Agriculture, 3 Vols. Bombay, 1901.
60. MURRAY, J. A.—Soils and Manures.
61. NICHOLAS, H. A. A.—Text-book of Tropical Agriculture. London, 1906.

62. OSTWALD, W.—Conversations on Chemistry. Trans. Ramsay, E. C., Part I. New York, 1911. Trans. Turnbull, S. K., Part 2. New York, 1908.
63. OWEN, T. C.—Notes on Cardamom Cultivation.
64. PAPINOE, P. B.—Date-Growing in the Old and New Worlds.
65. PEAKE, R. J.—Cotton, from the Raw Material to the Finished Product.
66. Pearson, R. H.—The Book of Garden Pests.
67. PERCIVAL, J.—Agricultural Bacteriology. London.
68. PROTHERO, R. E.—English Farming. Past and Present. New York, 1912.
69. ROBERTS, I. P.—The Farmers' Business Handbook. New York, 1911.
70. ROBERTS, I. P.—The Fertility of the Land. New York, 1909.
71. ROMANES, G. J.—Animal Intelligence. London, 1910.
72. ROYLE, H.—On the Culture and Commerce of Cotton in India and Elsewhere. London, 1851.
73. RUSSEL, E. J.—Lessons on Soil. Cambridge, 1912.
74. RUSSEL, E. J.—Soils and Manures. Cambridge, 1915.
75. SCOTT, H.—Agricultural Surveying. (Wales Scientific and Technical Series.)
76. SCOTT, J.—Text-book of Farm Engineering. London.
77. SCOTT, J.—Barn Implements and Machines. (Wales Technical and Scientific Series). London, 1904.
78. SCOTT, J. Y. AND MORTAN, J. C.—The Soil. (No. 4, Morton's Handbook of the Farm.)
79. SCOTT BURN, R.—Farm Management. (Wales Scientific and Technical Series), London.
80. STEWARD, A. C.—Darwin and Modern Science. Cambridge, 1910.
81. SHELDON, J. P.—The Farm and the Dairy, 5th Edition. London, 1911.
82. SHELDON, J. P.—British Dairying, 3rd Edition.
83. SHORT, J.—A Manual of Indian Cattle and Sheep. Madras, 1889.
84. SNYDER, H.—Dairy Chemistry. New York, 1911.
85. SNYDER, H.—The Chemistry of Plant and Animal Life. New York, 1912.
86. SNYDER, H.—Soils and Fertilizers. New York, 1912.
87. SOILLER, J. N.—Elements and Principles of Scientific Agriculture, Japan, 1908.
88. SOMERVILLE, W.—Farm and Garden Insects. London, 1910.
89. SOMERVILLE, W.—Agriculture. London, 1912.

90. STEVENS, F. L. and HALL.—Diseases of Economic Plants. New York, 1910.
91. SENPER, K.—The Natural Conditions of Existence as they affect Animal Life.
92. TANNER, H.—Elementary School Reading on the Principles of Agriculture for the 3rd Stage. London, 1900.
93. TANNER, H.—Further Steps in the Principles of Agriculture for the 2nd Stage. 1903.
94. TANNER, A.—Elementary Lessons in the Science of Agricultural Practice. London, 1893.
95. TANNER, H.—Lessons on the Principles of Agriculture. Elementary and Advanced. London, 1906.
96. TAYLER, H. C.—An Introduction to the Study of Agricultural Economics. New York, 1912.
97. TWEED, I.—Poultry-Keeping in India, 3rd Edition. Calcutta.
98. VOORHEES, E. B.—Fertilizers. New York, 1901.
99. VOORHEES, E. B.—Forage Crops for Soiling, Silage, Hay and Pasture. London, 1911.
100. WATTS, SIR FRANCIS.—Nature Teaching. His Majesty's Stationery Office. London, 1918.
101. WARINGTON, R.—No. 1, Chemistry of the Farm (Morton's Handbook of the Farm), 20th Edition. London, 1909.
102. WARINGTON, R.—Lectures on Some of the Physical Properties of the Soil. Oxford, 1909.
103. WARREN, G. H.—Farm Management. New York, 1914.
104. WARREN, G. H.—Elements of Agriculture. New York, 1912.
105. WEBB, H. G.—Advanced Agriculture. London, 1908.
106. WIDSTOE, A.—Dry Farming. New York, 1913.
107. WIDSTOE, J. E.—Dry Farming—A System of Agriculture for Countries under a Low Rainfall. New York, 1911.
108. WILCOX, E. V.—Farm Animals, Horses, Cows, Sheep, Swine, Goats, Poultry, etc. London, 1907.
109. WILCOX, L. M.—Irrigation Farming. A Handbook for the Proper Application of Water in the Production of Crops. New York, 1912.
110. WILCOX, E. M.—Tropical Agriculture.
111. WILLIS, J. C.—Agriculture in the Tropics. An Elementary Treatise. Cambridge, 1909.
112. WILSON JAMES.—The Principles of Stock Breeding. London, 1912.
113. WILSON, L. L. MRS.—Nature Study in Elementary Schools. Teachers' Manual. 1909.
114. WING, H. H.—Milk and Its Products. New York, 1909.